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A SURVEY OF THE FARALLON ISLANDS RADIOACTIVE WASTE DISPOSAL SITE

Interstate Electronics Corporation

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16. Abstracts

This is a summary of the August 1974 survey of a waste disposal site near the Farallon Islands that had been used between 1946 and 1966 for the disposal of radioactive waste materials. This survey was the first in which a deepwater (850) meter radioactive waste disposal site had been successfully relocated and subjected to a comprehensive survey. The U.S. Navy's CURV III, an unmanned remote controlled submersible, was used to investigate the condition of the containers. The report contains site location chart and high quality benthic color plates showing the condition of the containers.

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THE FARALLON ISLAND SURVEY

In August 1974, a survey was made near the Farallon Islands of a site that had been used between 1946 and 1966 for disposal of radioactive waste materials. This was the first time a deepwater radioactive waste disposal site had been successfully relocated and subjected to a comprehensive survey. The Farallon Islands are a chain of small, uninhabited islands extending in a northwest direction about 40 miles west of San Francisco, California (Figure 1). This survey resulted from a feasibility study conducted for the Office of Radiation Programs coupled with information that had been developed during the development of criteria for the control of ocean waste disposal. The feasibility study, completed in May 1974, consisted of a literature survey and personal field interviews concerning the radioactive waste disposal activities at various sites in the vicinity of the Farallon Islands (18).*

Interstate Electronics Corporation was selected as the mission contractor to integrate the services of the U.S. Navy Undersea Center, San Diego, and other participants. The survey was conducted for the U.S. Environmental Protection Agency, Office of Water Programs Operations and Office of Radiation Programs.

Information obtained verified that the historic disposal site near the Farallon Islands was, in reality, three distinct and separate sites, as shown in Figure 1. This area has the longest history of

*Numbers in parentheses refer to references in the bibliography.

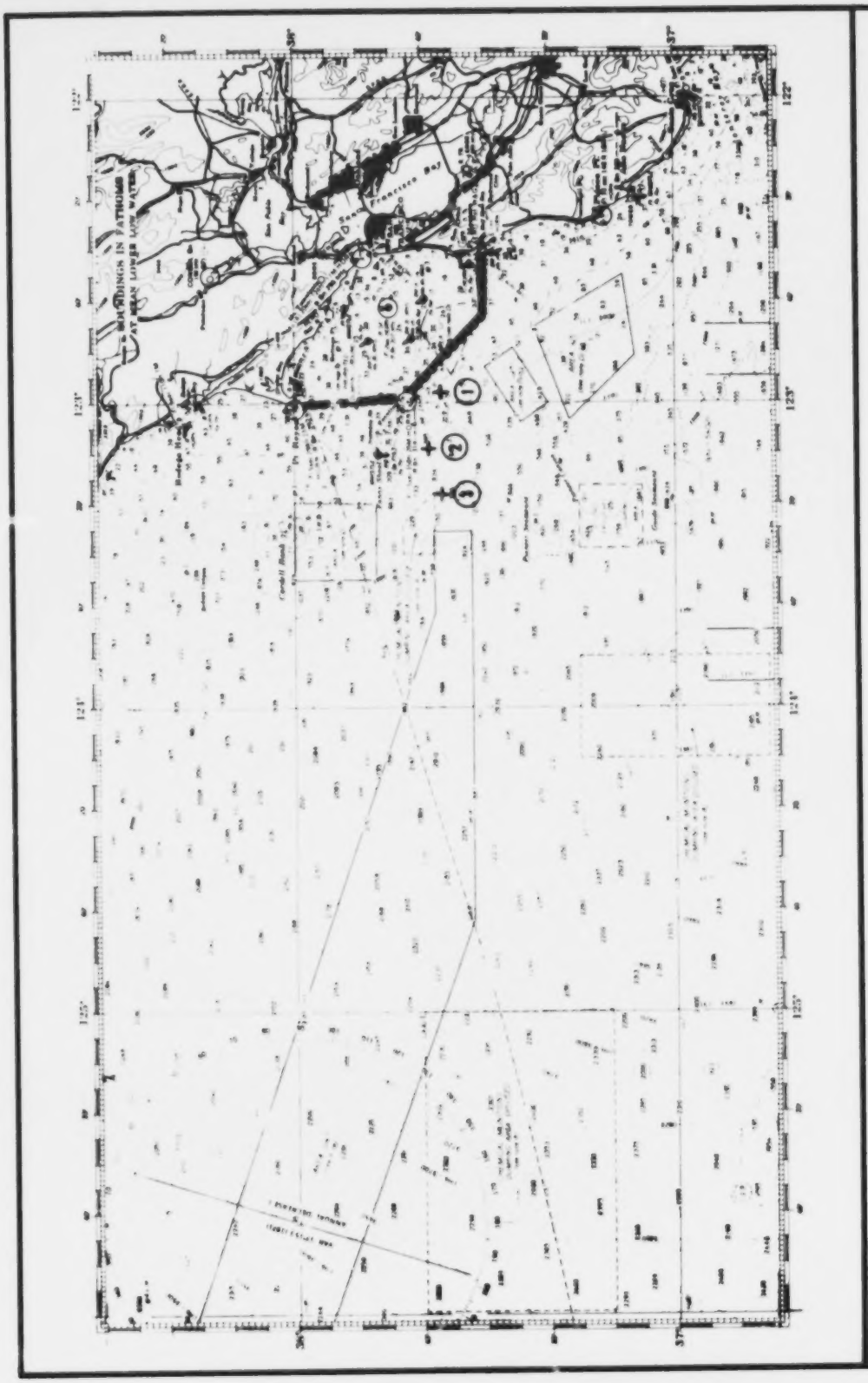


Figure 1

Farallon Island Waste Disposal Sites

radioactive waste disposal on the U.S. Pacific coast. The quantities of material that had been disposed of there were estimated to be 150 containers at Site 1, 3,600 containers at Site 2, and 44,000 containers at Site 3.

A program for the field investigation of these sites was developed in July 1974. Survey requirements were such that an unmanned submersible, such as the U.S. Navy's cable-controlled underwater recovery vehicle (CURV III), Figure 2, could provide the necessary sampling and monitoring capabilities at a cost considerably lower than that of a manned submersible. The CURV, operated by the U.S. Navy Undersea Center in San Diego, had proven its capabilities in recovering the hydrogen bomb lost off Palomares, Spain, in 1966, and in the rescue of the manned submersible, Pisces, in 1973.

Preplotted hydrographic sheets of the entire area, at a scale of 1:24,000, were prepared from the information obtained during the earlier feasibility study. A Motorola Radio Positioning System (RPS) range-range type of highly accurate navigation and track-plotting system was used for the survey.

The order to proceed was given August 13. The U.S. Navy Supervisor of Salvage made available the M/V Gear (Figure 3) for the operation. Equipment was placed on board, and the M/V Gear sailed from San Diego on August 24. Operations commenced on August 26 and were completed on August 30.

The operation began with the successful launch of the CURV III in a search mode to investigate the area known as Site 2 (Figure 1) on a predetermined grid pattern selected to provide complete sonar coverage of the bottom. On the first day, one drum was discovered and photographed; however, not enough data could be obtained to ascertain that it had been used for radioactive waste disposal. On

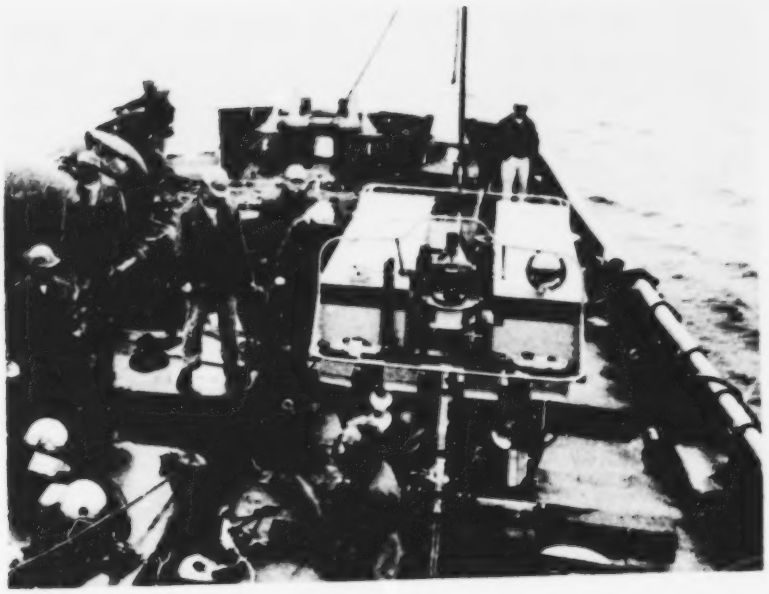


Figure 2

U.S. Navy's CURV III

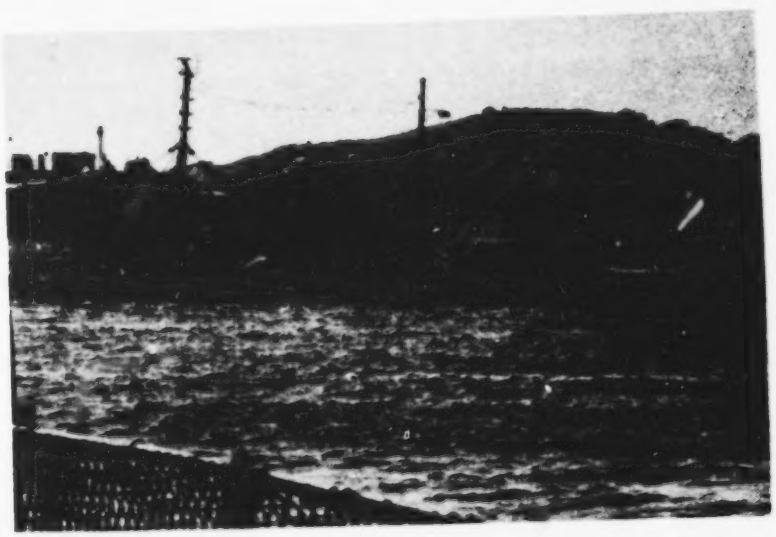


Figure 3

M/V GEAR, Support Ship for Survey

August 27, the first large cluster of disposal containers was located. Their unique packing configurations indicated without a doubt that an actual disposal site had been reached.

It was originally planned that, after an adequate survey of Site 2 had been completed, a 6,000-foot dive would be made at Site 3 to investigate the condition of the containers in that disposal area. However, the time required to adequately collect sediment samples and photograph the containers at Site 2 was such that the 6,000-foot dive had to be postponed.

A detailed description of the at-sea operations is presented in the report entitled "A Survey of the Farallon Islands Radioactive Waste Disposal Site" (19), for the U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, D.C., U.S.A.

One-hundred-seventy-six benthic color photographs were obtained at a depth of approximately 850 meters with a 35-mm color camera; twenty prints selected from these are presented on the following Plates 1, 2, 3, and 4. The two black and white photographs were reproduced from television videotape.

A short bibliography of publications related to this survey and a directory of principal program participants have been appended.

DESCRIPTION OF PHOTOGRAPHS

Frame 357 — Fifty-five gallon radioactive waste barrel showing a moderate amount of hydrostatic crushing. A lifting eye is evident on the left end of the barrel. A deepsea sole, Embassichythys bathybius, is occupying the upper indented area.

Frame 364 — This barrel was lifted by the manipulator arm of CURV III to show the extent of barrel penetration into the sediment. The sediment under the barrel shows black bands that may indicate anoxic corrosion of the barrel.

Frame 367 — Another example of hydrostatic crushing at the center of a barrel, a common failure mode. A lifting eye of wire rope is visible in the right center edge of the photo. The CURV III manipulator is in the left third of the photo.

Frame 372 — Closeup view of the concrete cap in a typical radwaste barrel. CURV III manipulator hydraulic hoses are in the foreground.

Frame 374 — Barrel in foreground shows effect of hydrostatic pressure in warping the length of a barrel. An anemone is attached to the concrete cap. Another barrel is seen in the background.

Frame 379 — View of underside of barrel that was rolled over. Good view of lifting eye in the concrete cap. Black deposits typical of anoxic corrosion are visible and appear to start a short distance below the sediment surface.

Frame 388 A barrel with no evidence of hydrostatic crushing. A coating of fine, minimally disturbed sediments is prominent on the upper area of the barrel, indicating the relatively small amount of sediments deposited since disposal 22 to 24 years ago.

Frame 403 Closeup view of a lifting eye on a barrel. This barrel's concrete cap is recessed inside the barrel end. Note barrel immediately adjacent in background, also flat fish partly visible beneath sediment cloud.

Frame 404 View of upper surface of barrel shown in Frame 403. This barrel appears to have ruptured, as evidenced by the sharp edges of the crushed area. TV viewing confirmed this. A poor-quality photograph of this crushed area, taken from the videotape coverage, is shown in the TV 2 photo which was taken from another angle.

Frame 409 Upright barrel showing large vase sponge attached to barrel.

Frame 410 This photo shows the type of clustering of barrels that was typical of the sites. Three barrels are in the field of the camera (camera range was about 12 feet). This type of clustering establishes the fact that the barrels were released at one time from a hopper-type barge, rather than being dumped individually over the side.

Frame 413 View of a 55-gallon drum with a metal lid. A thornyhead, either Sebastolobus alascanus (short-spined) or S. altivelis (long-spined), and a tanner crab, Chionoecetes tanneri, are visible near the barrel end.

Frame 415 An example of the extreme crushing some barrels exhibited. Failure of most barrels was in the center third of the barrels as shown here.

Frame 484 Barrel with atypical crushing of one of the ends. It would appear that the waste, containing air voids, was improperly packaged without an adequate concrete plug at one end.

Frame 486 Undecipherable lettering is visible on this end-crushed barrel. Two Sebastolobus are in front of the barrel. Two anemones, on an unidentified biotic substrate, are immediately in front of the barrel. A poor-resolution print from a video tape closeup is shown in TV 1 on next page.

Frame 487 Closeup of the 55-gallon drum shown in Frame 486.

Frame 492 Example of the typical implosion pattern of the many barrels sighted, similar to laboratory or field experiments on test containers at the corresponding depth. The crushed portion is a series of regular indentations with a slight twist in the longitudinal axis. A closed cylinder under external hydrostatic pressure would collapse similarly.

Frame 494 A barrel, pushed over by CURV III, that has numerous sponges attached. This is a good example of the many similarly sighted barrels showing potential biological action on the container and propensity of some invertebrates to seek this substrate for attachment.

Frame 496 Upright barrel with large sponge attached. The area near the top left edge of the barrel, where some Hydrozoans are seen, appears to be breached. Note that this

barrel has a metal lid (possibly bottom).

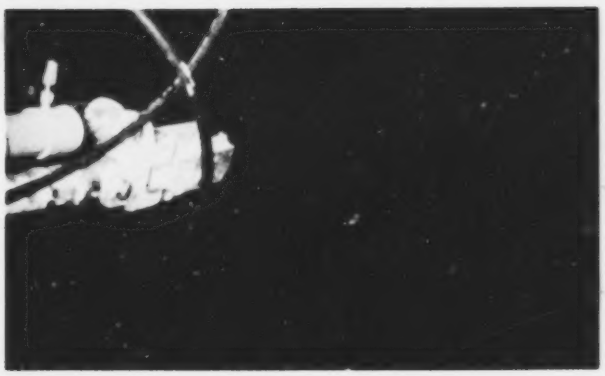
Frame 522 — When the CURV manipulator attempted to remove a sponge sample, the sponge fell away leaving the corroded inner matrix exposed. The detached sponge still retained a large piece of the barrel along its base of attachment. The metal of the barrel was corroded and flaky. Note shrimp near lower middle right of photo, just below manipulator cable.

TV 1 — Closeup of barrel end - also shown in Frame 486 and 487. The reproduction of videotape TV record was of poor quality.

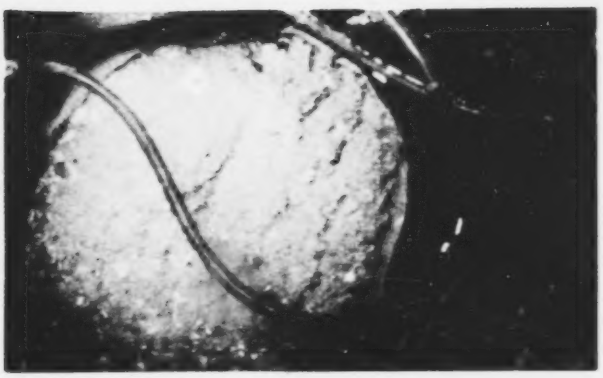
TV 2 — Closeup, from another angle, of apparently ruptured area of drum shown in Frame 404.

FRAME 357

FRAME 364



FRAME 367



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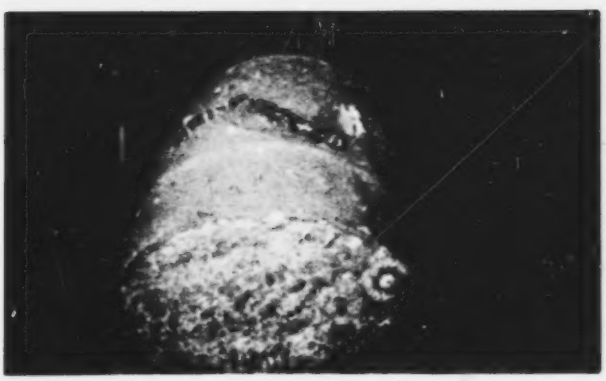

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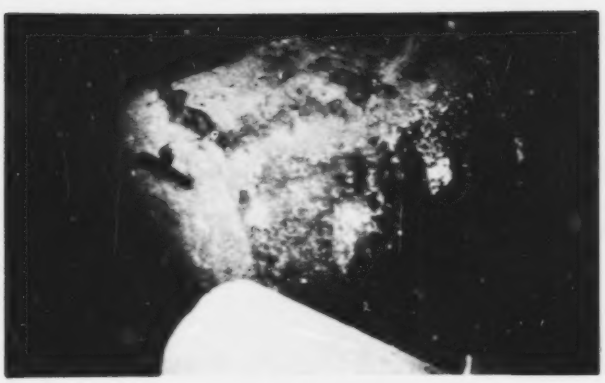
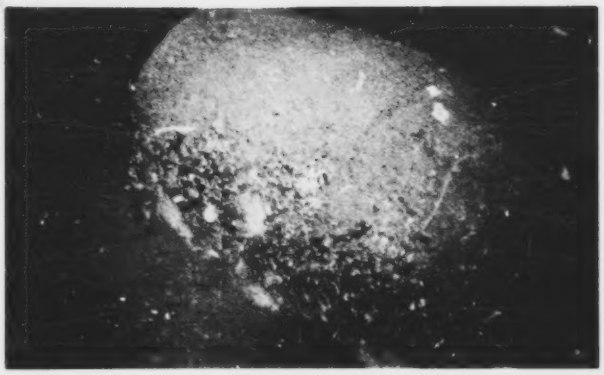


FRAME 379

Plate 1



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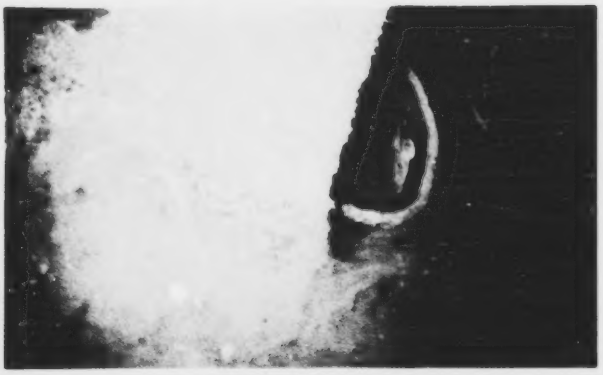

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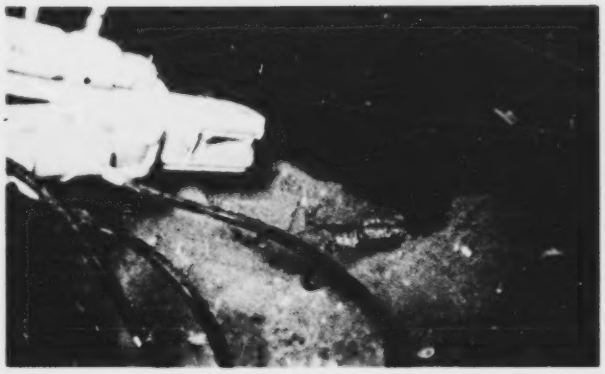
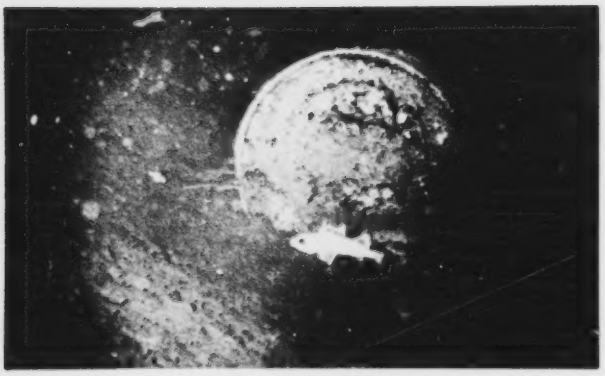


FRAME 404

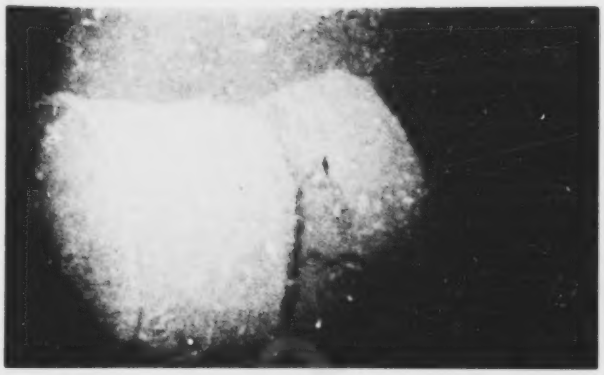
FRAME 409

FRAME 410



FRAME 413

Plate 2

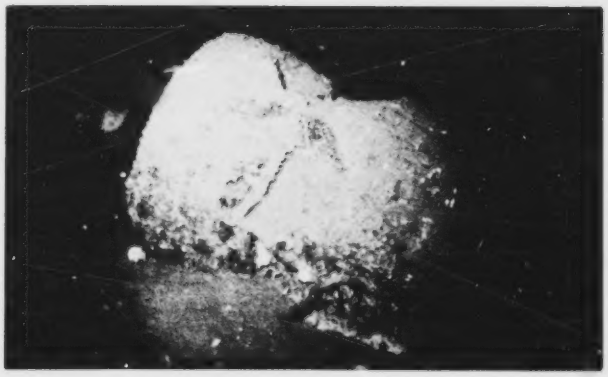


FRAME 415

FRAME 484

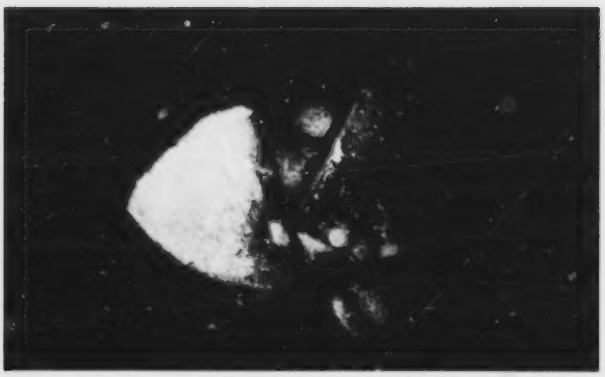
FRAME 486

FRAME 487



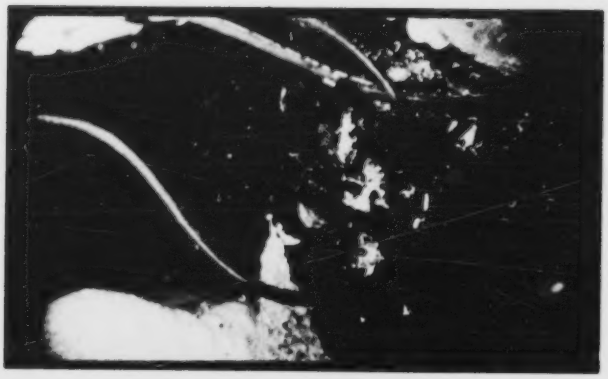
FRAME 492

Plate 3



FRAME 494

FRAME 496



FRAME 522

TV 1

TV 2

Plate 4

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DUMP SITES
April 1972